

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: **Dae-Woo Lee** Confirmation No. **9120**
Serial No. **09/712,029** Examiner: **John L. Goff II**
Filed: **November 13, 2000** Group Art Unit: **1733**
For: **METHOD OF MANUFACTURING UNVULCANIZED ADHESIVE
WATERPROOF SHEET AND CONSTRUCTION METHOD USING THE SAME**

DECLARATION UNDER 37 C.F.R. 1.132

DECLARATION OF DAE WOO LEE

I, Dae Woo Lee, declare the following:

1. I was awarded a B.S. degree in Chemical Engineering from Hanyang University in Korea. My employment experience spans more than thirty years and involves various high polymer chemistry technologies. In more detail, I served as: factory manager for Dong-A Rubber Co. from 1971 through 1975; chief executive officer (CEO) for Wooshin Rubber Chemical Inc. from 1976 through 1982; CEO for Shinsung Manufacture Co. from 1982 through 2002 ;and CEO for MyungJin Chemical Co. since 2002.
2. I received approximately fifty (50) Korean patents, the subject matter of these patents relating primarily to high polymer technology, e.g. adhesive waterproof sheets for construction and rubber packing.
3. I have extensive training and experience in all aspects of high polymer chemistry including various high polymer materials. I have also received various awards for developing high polymer technologies, including one award from Korean Intellectual Property Office for the invention disclosed in the present application. (See attached.)
4. I have read and understood: U.S. Pat. Serial No. 09/712,029, as filed and as recently amended; U.S. Pat. No. 4,551,392 to Draexler, U.S. Pat. No. 2,656,292 to Hoover, the

United States Patent and Trademark Office's Office Action mailed on June 23, 2003.; and the applicants' Amendment and Remarks mailed on May 27, 2003.

5. In my experience, the ratio of adhesion-providing agents in manufacturing rubber is low, that is, about 1-5%. By contrast, the claimed invention includes about 40% adhesion-providing agent. Using this significantly higher percentage of adhesion-providing agent results in an adhesive waterproof rubber sheet that successfully adheres to even wet concrete, cement, or other construction materials without adversely affecting the structural characteristics of the rubber sheet. This benefit is striking and unexpected, and the greatly increased ratio (as claimed) would not be obvious to one in rubber manufacturing.

6. Draexler '392 is directed to a composite material comprised of multiple sheets, including a synthetic rubber sheet having an adhesion-providing agent therein. The reference teaches that the amount of this agent can be "conventionally determined." (See col. 2, lines 55-63). However, Draexler fails to teach or fairly suggest an adhesion-providing agent ratio in the range of 41%. One of ordinary skill in the art would interpret Draexler '392 as teaching/suggesting that "conventional" levels of this agent be used—that is, in the range of 1-5%.

7. I believe that the employment of an adhesion-providing agent in the claimed ratio—greatly elevated in comparison to the prior art—would not have been obvious to one of ordinary skill in the art as of November 3, 2000. Similarly, the resultant benefit to a rubber sheet having an adhesion-providing agent would not be apparent to the skilled artisan absent the disclosure of such in the present patent application.

8. I base my conclusion on my extensive experience in the field of adhesive waterproof materials. I also note that neither Draexler (U.S. Pat. No. 4,551,392) nor Hoover (U.S. Pat. No. 2,656,292) suggest to me the use of an adhesion-providing agent in a ratio

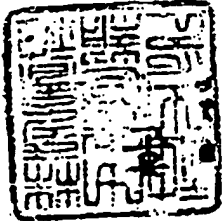
higher than known amounts (1-5%) at the time the present application was filed, i.e. November 13, 2000.

I, the undersigned, declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and further, that these statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

DATED this 24 day of November, 2003.



Dae Woo Lee



제 이 장 사 자 인 공

특 령 청 자 간 관



2002년 12월 17일

귀하의 위 법면은 그 기종이 뛰어나
특허청과 중앙일보가 시행하는 2002년도
4분기 특허기술상으로 선정되었습니다
이 상장과 부상을 드립니다.

반면의 명칭 : 미가불 상세인 특허청 만수시트인 제조방법 및
그것을 이용한 자용한 지온방법
(특허청원 제99-50626호)

이 때 이
공무공자

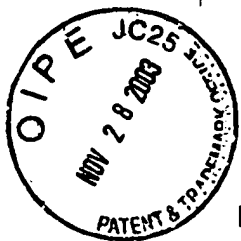
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METHOD OF MANUFACTURING UNVULCANIZED ADHESIVE
WATERPROOF SHEET AND
CONSTRUCTION METHOD USING THE SAME

This application relies for priority upon Korean Patent
5 Application No. 1999-50626, filed on November 15, 1999, the
contents of which are herein incorporated by reference in their
entirety.

FIELD OF THE INVENTION

10 The present invention generally relates to a method for
manufacturing of an unvulcanized adhesive waterproof sheet and
a construction method using the sheet. Particularly, the present
invention relates to a method of manufacturing an unvulcanized
adhesive waterproof sheet for waterproofing of a cut and cover
15 tunnel, an underground building structure, or a concrete structure
such as a building wall or an underground driveway. And,
particularly, the present invention relates to a construction method
using the sheet.

20 BACKGROUND OF THE INVENTION

As civil and construction technologies have progressed,
complex and difficult construction methods can now easily be
accomplished. However, defects often occur in waterproof
construction situations. The defects cause water leakage and
25 flooding. Moreover, the defects can cause a completed structure

to sustain damage and lead to structural deterioration.

Accordingly, a waterproof construction is important in the civil and construction technologies. At present, it is desirable to produce excellent waterproof materials which can exert a continuous and perfect waterproof function without subsequent need for maintenance or replacement.

Accordingly, a penetrating silicon waterproof agent, a rubberized asphalt sheet, a water soluble rubberized asphalt paint (aqueous paint film waterproof), a vulcanized rubber (boiled rubber) sheet, and an organic solvent rubber paint (oil paint film waterproof) have been used.

Since cement strength has improved to over 400kg/cm² due to development of the construction technology, penetration waterproof agent has proved to be a dispreferred material.

A rubberized asphalt sheet is cheap, and performs well a short time after installation when waterproofed. Unfortunately, the elasticity of the rubberized asphalt sheet degrades with the passage of time. In hot weather (e.g., summer), the sheet is dissolved and vaporized . As this happens, the sheet hardens and shrinks, resulting in water leakage and flooding.

Further, when the rubberized asphalt sheet is attached to external walls of a construction structure, humidity or moisture makes it impossible to attach the rubberized asphalt sheet to the concrete (or similar material) construction. Although a surface of the external wall may be dried well, the sheet only partially

attaches thereto. Thus, a conventional rubberized asphalt sheet has fallen into disfavor.

In the water soluble rubberized asphalt paint, asphalt is mixed and agitated with emulsifier, and latex is added thereto.

5 Accordingly, application of asphalt paint (i.e. the waterproof material) is simplified. However, since a main ingredient of the paint is asphalt, the paint has the same drawbacks as a rubberized asphalt sheet. Moreover, liquid asphalt paint is difficult to apply to form a waterproof film having a constant thickness if
10 the construction surface is not planar.

A vulcanized rubber sheet is manufactured by boiling, and such a sheet has greater elasticity, tension, and tensile force than untreated rubber. Accordingly, the vulcanized rubber sheet is good for resistance to vibration, shock, and chemicals. In addition,
15 physical properties and waterproof performance are excellent. The vulcanized rubber sheet, however, is difficult to completely attach to external walls of a structure. This results in water leakage and deterioration of the waterproof function.

In order to remedy drawbacks of the above-mentioned
20 waterproof materials, organic rubber paint was developed which uses rubber as a base material. The rubber is dissolved in a volatile solvent, such as toluene and thinner, using a liquid agitator, to manufacture the organic solvent rubber paint.

Compared with the vulcanized rubber sheet, the rubber paint is
25 simpler to use. When the solvent is evaporated, the rubber paint is

transformed to a rubber sheet. Therefore, organic rubber paint is a good waterproof agent. However, elasticity, peel strength, and tensile force of rubber paint are lower than those of a vulcanized rubber sheet because the manufactured rubber sheet is in an unvulcanized rubber gray state. If a paint film waterproof agent using an oil rubber as a main material is applied once, a rubber film is formed after evaporation of the solvent. At this time, the rubber film shrinks and the thickness thereof is reduced to 0.2mm-0.4mm. In order to form a waterproof film having a constant thickness (1mm-2mm), rubber paint must repeatedly be coated. Since the each coat of rubber paint must be left for 5-6 hours so as to dry the solvent, soil or dust is fixed to a coating surface. Therefore, the waterproof film is divided into a plurality of films. Further, air bubbles or air pockets are considerably likelier to be created under the rubber film formed by rubber paint.

Although concrete used in civil and construction structures is dried well, it generally has a moisture content of 10%-20%. In most case, concrete used in an underground structure has a moisture content of 80%-90%. As mentioned above, moisture content of the conventional waterproof agents is high. Therefore, the agents cannot attach to the concrete. Although a waterproof agent can be attached to concrete using a lamp or a burner, the resultant construction is still unstably attached and waterproof defects can be present.

In order to prevent damage of the waterproof film, the conventional waterproof agents must use a waterproof film protectant such as an EVA (ethylene vinyl acetate) bubbling sheet or a PE (polyethylene) fibrous sheet. However, the protectant is
5 forced out or damaged and the waterproof film is attacked in a refilling process. Unfortunately, the protectant causes the defects. On the other hand, in order to protect the waterproof film, bricks are laid to form a wall, and then a refilling process is carried out. Such a manner increases both the term of the work and the cost.

10

SUMMARY OF THE INVENTION

It is therefore an object of the invention to provide a method of manufacturing an unvulcanized adhesive waterproof sheet and a construction method using the sheet which can simply perform a
15 waterproof construction of a civil structure and maintain waterproof performance for a long time.

It is another object of the invention to provide a method of manufacturing an unvulcanized adhesive waterproof sheet and a construction method using the sheet which can easily and stably
20 be attached to a construction surface containing humidity or moisture.

According to an aspect of the invention, a method of manufacturing an unvulcanized adhesive waterproof sheet comprises the steps of agitating a rubber main material composed
25 of at least one of a natural rubber and a synthetic rubber with a

vulcanizing compound agent, an age resister, an adhesion-
providing agent, a softener, and a filler, and then adding and
agitating a vulcanizing agent thereto in an open roller, thereby
producing a raw rubber material; rolling and forcing out the raw
5 rubber material with constant width and thickness, thereby
manufacturing a waterproof sheet; and attaching a releasing paper
to both surfaces of the waterproof sheet, being cut with a constant
length.

The age resister includes at least one compound selected
10 from a group consisting of phenylisopropyl-p-phenylenediamin,
polymerized trimethyl dihydroquinoline, and styreneated phenol.
The adhesion-providing agent includes at least one of tragacanth
rubber and polyvinyl poval (PVA) that is affined with water.

According to another aspect of the invention, a construction
15 method uses the unvulcanized adhesive waterproof sheet. One
surface of the waterproof sheet attaches to a surface of a
structure. The other sheet surface attaches to wet mortar, the
sheet having a constant thickness. At this time, the waterproof
sheet is turned into a vulcanized rubber so as to achieve
20 waterproofness of the structure after attachment thereto of the
sheet.

Before the waterproof sheet attaches to the surface, premier
(produced by dissolving the raw rubber material in organic
solvent) is coated on the construction surface. When the
25 waterproof sheet attaches to the surface, the waterproof sheet and

the construction surface are coupled and opposed with each other. Then, the overlapped portion adheres to the construction surface via the premier. Before the waterproof sheet attaches to the surface, water leakage, which may be caused by cracks of the construction surface, are closed using an adhesion agent produced by dissolving the raw rubber material in a selected amount of organic solvent. After the cracks are closed using the adhesion agent, the premier is coated on the surface.

10 DESCRIPTION OF THE PREFERRED EMBODIMENT

A waterproof agent made of asphalt is superior in performance to that made of rubber. Accordingly, a perfect waterproof sheet must have characteristics as follows. First, an ideal rubber film has a constant thickness. Second, the elements of the composite are monolithically and easily coupled to each other, and perfectly attach to each other. Third, a waterproof sheet to be used in construction should be a vulcanized rubber sheet having good elasticity, tension, and tensile force that are intrinsic properties of a rubber. Reference is directed to patents using an unvulcanized adhesive waterproof sheet using rubber as a main material (Korean Patent Application No. 95-5008 entitled "MANUFACTURING METHOD OF UNVULCANIZED ADHESIVE WATERPROOF SHEET AND CONSTRUCTION METHOD THEREOF" and Korean Patent Application No. 96-37884 entitled

"METHOD OF MANUFACTURING UNVULCANIZED ADHESIVE
WATERPROOF SHEET ").

In these patents, an adhesive gray-state unvulcanized
waterproof sheet with a vulcanized agent is manufactured to have
5 a constant width and thickness. Accordingly, in a construction
process using the sheet, the thickness is constant and attaching
surfaces are monolithically attached to each other. This makes it
possible to attach a piece of rubber sheet to even a wide area.
The sheet is secondarily-activated at ordinary temperature, being
10 turned into a vulcanized rubber sheet. Tension and tensile force of
the sheet can fill concrete cracks due to sealing thereof. As a
result, the sheet provides a perfect water-stopping effect.

However, the adhesive gray-state unvulcanized waterproof
sheet adding a vulcanized agent suffers from an aging
15 phenomenon. For example, when the sheet is exposed to
sunshine, rain, and wind on a rooftop of a building for three or
four months, cracks are created on a surface of the sheet.
Therefore, the present invention provides a new and improved
manufacturing method of an unvulcanized adhesive waterproof
20 sheet and a waterproof construction thereof, with repetitive test
and study.

The use of the present adhesive waterproof sheet in
construction is performed through the following steps. Primer
(produced by dissolving a raw material of rubber in a constant
25 amount of organic solvent) is coated on a construction surface.

The unvulcanized rubber sheet is attached to the surface. Wet cement mortar, which is kneaded with water, attaches to protect the attached waterproof film. The mortar is hardened and cured. Finally, a refilling process is performed. After the waterproof construction is finished, the sheet is activated to be a molded vulcanized rubber with time. More specifically, primer is coated on, e.g., a cut and cover tunnel, an underground structure of a building, and a building wall. With an adhesive unvulcanized rubber sheet in an adhesive rubber gray state, an attachment to the construction surface is monolithically performed without an expansion opening. Wet mortar kneaded with water attaches onto a surface of the waterproof sheet. The wet mortar is dried and cured. Since the mortar and adhesive unvulcanized rubber are adhesive, they strongly attach. The unvulcanized rubber sheet is secondarily-activated at ordinary temperature, being turned into a molded vulcanized rubber sheet. The molding vulcanized rubber sheet then is turned into a rubber sheet having elasticity, tension, and tensile force that are intrinsic properties of the rubber, creating a perfect waterproof construction effect. Using the molded and vulcanized rubber sheet as a medium, both walls attach to each other by concrete. Therefore, it is possible to achieve a waterproof construction process without defects in waterproofness.

An unvulcanized adhesive waterproof sheet of this invention is produced by adding a rubber material composed of at least one

of natural rubber and synthetic rubber to a vulcanizing agent, an age resister, an adhesion-providing agent, a softener, a filler, and a vulcanizing agent. Such agents are added to natural rubber or synthetic rubber or combination thereof or a combined rubber
5 produced by adding rubber powder or recycled rubber to the natural rubber or the synthetic rubber. The agents and one of the rubbers are then mixed and agitated in a closed mixer (e.g., kneader or Bandury), being evenly distributed. The agitation is performed in an open roller, with addition of the vulcanizing agent.
10 The agitated raw material of the adhesive rubber is rolled in a calender, having a constant width and a thickness of 1mm-5mm. The rolled material is fetched to the sheet, and then is cut with a constant thickness. Finally, the rolled and fetched rubber sheet is rolled up, with silicon-coated releasing paper attaching to both
15 surfaces thereof.

The unvulcanized adhesive rubber sheet can be used in construction applications where the sheet will be exposed to the weather. Durability of the sheet is five years. In order to maintain a waterproof function for a long time, it is required to add a
20 special age resister to the sheet. Therefore, the present invention uses age resisters, such as "3C" (Phenylisopropyl-p-phenylenediamin), "RD" (Polymerized trimethyl dihydroquinoline), and "SP" (Styrenated phenol). The "3C" compound is good for heat resistance, flexure-crack resistance, oxidation resistance, and
25 ozone resistance. The "RD" compound is good for heat resistance

and oxidation resistance. The “SP” compound is good for flexure resistance, oxidation resistance, and ozone resistance. Adding such age resisters to the sheet results in a sheet which maintains its initial state for a long time. When the sheet attached to a rooftop is left for two years (two summers and winters), cracks or
5 rips are not created on a surface of the sheet. In case of a sun exposure construction application, the sheet exerts an excellent waterproof function for a long time.

Generally, a waterproof construction process is desirable for
10 an external wall of a structure. Accordingly, the construction is performed in an external wall of concrete using a waterproof material. In order to protect the waterproof material, an EVA blowing sheet or PE fibrous sheet is applied to an outside of the waterproof material. However, the EVA blowing sheet or PE
15 fibrous sheet is difficult to attach to a corner or a flexure (curved construction surface), and incompletely attaches to the waterproof material. In a refilling process, a protectant is forced out or damaged and a waterproof film is attacked. Unfortunately, the protectant also causes defects. Instead of EVA blowing sheet and
20 PE fiber, cement mortar is used as a waterproof protectant so as to solve such defects and protect a waterproof film. Therefore, the rubber sheet can be simply attached to a corner or a complex flexure. Using a waterproof sheet as a sandwiched medium, an inside construction surface adheres to an outside construction

surface , the sheet being closed therebetween to achieve a perfect waterproof construction.

In order to use mortar as a waterproof film protectant, the unvulcanized adhesive waterproof sheet adds Tragacanth Gum and PVA (polyvinyl Poval) resin to the adhesion-providing agent. The Tragacanth Gum and PVA resin is affined with water and is compatible with other material, being mixed well. The sheet containing an adhesion-providing agent and the raw rubber material are dissolved in a constant amount of organic solvent, forming premier which enables the sheet to perfectly attach to a construction surface containing moisture. Even though an underground structure contains moisture on the order of 80%-90%, the sheet can eminently attach thereto. According to experimental results, when the premier is coated on a brick or a concrete piece with gathered water and the unvulcanized adhesive rubber sheet adhered thereto, the adhesion is strong. Since a surface of a structure in a work site generally has poor adherence conditions, the primer is used to enable an unvulcanized adhesive waterproof sheet to attach to a construction surface. And, the primer is used at an overlap portion of waterproof sheets.

In order to overcome conventional problems (exfoliation, cement exclusion, crack, etc.), the premier is coated on an external surface of concrete and the unvulcanized adhesive rubber sheet adheres thereon. Then, wet mortar kneaded with water attaches to a surface of the sheet. If the water is dried and

adhesion is created by curing the cement mortar, the waterproof film and the cement mortar strongly attach to each other. The sheet attaching to the mortar can absorb external impact and suppress creation of cracks.

5 In another embodiment, a construction method using the unvulcanized adhesive waterproof sheet utilizes putty that is produced by dissolving a raw rubber material in organic solvent such as toluene. The putty seals and prevents water leakage caused by cracks in a construction surface. Using the putty, the
10 cracks are closed. If the premier is then coated on the construction surface repeatedly and the sheet attached thereon, a better construction will be achieved.

 In view of the cost, a waterproof construction method using an unvulcanized adhesive waterproof sheet is cheaper than a
15 conventional method using an EVA blowing sheet, a PE fibrous sheet or a bricklaying method. And, such a waterproof construction method can solve conventional difficulties (e.g., a waterproof construction cannot be performed to a wet mortar kneaded in water as well as to a structure surface having humidity
20 or moisture, and the construction in these situations tends to result in construction defects).

PREFERRED EMBODIMENT

 An unvulcanized adhesive waterproof sheet of this invention
25 is composed of composites having a mixture ratio, as follows:

(Table unchanged from Original Specification)

Intrinsic physical properties and characteristics of the rubber
5 compound materials are different from each other. Therefore,
based on usage of a waterproof sheet or user preference, only one
of natural rubbers, synthetic rubbers, or a combination thereof
may be used. Alternatively, two and more kinds of synthetic
rubbers may be used. For example, a CR rubber main material has
10 the best properties such as adhesion, durability, and chemical
resistance.

The age resisters (3C, RD, and SP) are added to an
unvulcanized adhesive waterproof sheet, improving durability. In
order to maintain strong adhesion between composites of the
15 sheet and provide adhesiveness, the adhesion-providing agents
(polybutene, phenol-formaldehyde-resin, and petroleum resin)
are added thereto. And, in order to provide adhesion and
adhesiveness to wet mortar kneaded with water and a structure
having humidity and moisture, the tragacanth gum and the PVC
20 resin which are compatible with other composites are added
thereto. Since there are synergy and compatibility between a resin
of an adhesion-providing agent and a water-compatible resin,
adhesion and adhesiveness can be improved. And, a waterproof
construction can smoothly be performed at dry and wet conditions.

A method of manufacturing an unvulcanized adhesive waterproof sheet is composed of the following steps. One of natural and synthetic rubbers (SBR rubber, 1R rubber, EPT rubber, 2R rubber, CR rubber, NBR rubber, Urethane rubber, and CPE rubber) or combination (100%) thereof is fully agitated in a closed mixture agitator "Kneader Mixer" or "Bandury Mixer". The vulcanizing compound agents, stearic acid (1%), magnesium oxide (5%), zinc oxide (5%), and sulfur (2%) are evenly mixed therewith. The age resisters, 3C (2%), RD (1.5%), and SP (2%) are then agitated, being mixed and distributed evenly. Then, the adhesion-providing agents, polybutene (6%), phenol-formaldehyde-resin (8%), petroleum resin (10%), tragacanth gum (5%), and PVA (12%) are fully mixed and agitated therein. And then, the softener, process oil (14%) as well as the filler, calcium carbonate (40%) and clay (15%) are fully mixed and agitated therewith. With adhesive unvulcanized raw rubber material agitated in a roller, vulcanizing agents, DM (1.5%), D (1%), T/T (1%), and NA22 (1%) are added, being distributed and mixed evenly. In a calendar machine, the sheet is rolled and forced out with a constant width and a thickness of 1mm-5mm. Finally, the sheet is adhered to releasing paper of a high-density film (HD), polypropylene (PP), and polyethylene (PE), rolled up and cut with a constant length. The releasing paper of the rolled waterproof sheet must be uncovered in a waterproof construction. To be used as a material

of the releasing paper, silicon is coated on both surfaces of a synthetic resin film such as HD, PP, and PE.

Since the unvulcanized adhesive waterproof sheet has adhesiveness therein, its adhesion to concrete is excellent.

5 However, a construction surface of a structure in a work site is generally contaminated by cement powder, soil, dust, and dirt. Accordingly, the waterproof construction method utilizes premier (viscosity, 500-600) produced by dissolving the raw rubber material (weight, 50) in toluene (weight, 150). That is, the premier
10 is rendered on a concrete surface and the unvulcanized waterproof sheet attaches thereto, achieving a stronger attachment. Similarly, a coupling portion more strongly adheres by means of the premier.

In comparison with a conventional method, the present
15 invention makes it possible to simply coat the premier on a structure using a brush. The premier can effectively be coated on even metal or rusted iron, so that the unvulcanized waterproof sheet simply and strongly attaches thereto.

In case of water leakage caused by cracks of a construction
20 surface, an adhesion agent (viscosity, 1500-1700) produced by resolving the raw rubber material (weight, 500) in toluene (weight, 70) is utilized. After the cracks are closed using the adhesion agent, the water leakage is stopped and the premier is coated thereon. After solvent is dried and a premier film is formed, the

premier recoated thereon. A rubber sheet strongly attaches to the premier then, so that adhesion is achieved.

In the waterproof construction method, the unvulcanized adhesive waterproof sheet attaches to a construction surface.

5 Mortar of 10mm-20mm then attaches to a surface of the waterproof sheet. The more cement component is contained in mortar, the better adhesion is. Accordingly, this quality of the mortar is higher than that of standard mortar (cement 1 : sand 2.5). Moisture of the attaching cement mortar is evaporated to
10 create adhesion. After five or seven days, the mortar is cured to have strong adhesion. The attaching mortar having the strong adhesion can resist external impact (i.e., overcome exfoliation, evasion, breakage, and cracks). Using the unvulcanized adhesive waterproof sheet as a medium, internal and external walls
15 completely attach to each other. Thus, defects cannot occur.

In a waterproof construction to an external wall of a building, the premier is coated on the external wall to form a rubber film. Mortar kneaded with water attaches to a surface of the rubber film, being cured. Sidewalls are refilled with a good quality of
20 earth and sand. Then, water is sprayed to harden the earth and sand. An underground parking lot or a rooftop is amenable to a mortar (thickness, 2cm-3cm) construction, and is refilled in the same manner. The waterproof construction is then conducted as previously described. At ordinary temperatures, the unvulcanized
25 adhesive waterproof sheet is secondarily-activated, being turned

into a vulcanized rubber over time (1-2 months in summer, 2-3 months in winter). Therefore, the waterproof sheet has high tension and tensile force, and maintains its waterproof function. Further, heat resistance, cold resistance, and chemical resistance of the waterproof sheet are sufficiently good that the waterproof sheet can maintain its good physical properties in severe conditions. As a result, the waterproof sheet can maintain a waterproof function over the life of the building.

In the drawings and specification, there have been disclosed typical preferred embodiments of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for purpose of limitation, the scope of the invention being set forth in the following claims.

CLAIMS

What is claimed is:

(Claims 12-14 and 17 per the Amendment submitted herewith)

ABSTRACT OF THE DISCLOSURE

A method of manufacturing an unvulcanized adhesive waterproof sheet for performing a waterproof construction, and a construction method using the sheet are described. In the manufacturing method, a rubber main material composed of natural rubber and/or synthetic rubber is agitated with vulcanizing compound agent, age resister, adhesion-providing agent, softener, and filler. Vulcanizing agent is then added and agitated thereto in an open roller, thereby producing a raw rubber material, which is rolled and forced out with constant width and thickness. A releasing paper attaches to both surfaces of the waterproof sheet. In the construction method, one surface of the waterproof sheet attaches to a construction surface. The other sheet surface thereof attaches to wet mortar with a constant thickness. The waterproof sheet is turned into vulcanized rubber over time to achieve waterproofness of the construction.



METHOD OF MANUFACTURING UNVULCANIZED ADHESIVE
WATERPROOF SHEET AND
CONSTRUCTION METHOD USING THE SAME

This application relies for priority upon Korean Patent
5 Application No. 1999-50626, filed on November 15, 1999, the
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FIELD OF THE INVENTION

10 The present invention generally relates to a method for
manufacturing of an unvulcanized adhesive waterproof sheet and
a construction method using the sheet. Particularly, the present
invention relates to a method of manufacturing an unvulcanized
adhesive waterproof sheet for waterproofing of a cut and cover
15 tunnel, an underground building ~~structure of a building, and or a~~
concrete structure such as a building wall ~~and or~~ an underground
driveway. And, particularly, the present invention relates to a
construction method using the sheet.

20 BACKGROUND OF THE INVENTION

As civil and construction technologies have ~~recently been~~
~~developed~~ progressed, complex and difficult construction methods
can now easily be accomplished. However, defects often occur
~~only in the~~ waterproof construction situations. The defects cause
25 water leakage and ~~submergence~~ flooding. Moreover, the defects

~~bite and attack can cause a completed structure to sustain~~
~~damage and lead to structural deterioration.~~ Accordingly, a
waterproof construction ~~becomes~~ is important in the civil and
construction technologies. ~~In the~~ At present time, it is desperately
5 ~~required~~ desirable to produce excellent waterproof materials which
can exert a continuous and perfect waterproof function without
subsequent need for maintenance or replacement ~~only one~~
waterproof construction.

Accordingly, a ~~silicon penetrating~~ silicon waterproof agent,
10 a rubberized asphalt sheet, a water soluble rubberized asphalt
paint (aqueous paint film waterproof), a vulcanized rubber (boiled
rubber) sheet, and an organic solvent rubber paint (oil paint film
waterproof) have been used.

Since ~~a strength of the cement~~ strength is ~~has~~ improved to
15 over 400kg/cm² due to development of the construction
technology, ~~the penetration waterproof agent is~~ has proved to be
~~unsuitable a dispreferred~~ material.

~~The~~ A rubberized asphalt sheet is cheap, and ~~exerts a good~~
~~function in~~ performs well a short time after installation when
20 ~~because a physical property of the asphalt is waterproofed.~~
Unfortunately, the elasticity of the rubberized asphalt sheet is
~~reduced as degrades with the passage of time elapses.~~ Since ~~In~~
hot weather (e.g., summer), the sheet is dissolved and vaporized
at a high temperature ~~(e.g., summer),~~ As this happens, the
25 sheet it becomes hardens and. ~~And, a volume of the sheet is~~

~~reduced shrinks, resulting . This results in water leakage and submergenceflooding.~~

~~-Further, W~~when the rubberized asphalt sheet ~~is attached~~s to external walls of a construction structure, humidity or moisture makes it impossible to ~~carry out an attach~~ the rubberized asphalt sheet to the concrete (or similar material) construction. Although a surface of the external wall ~~is~~may be dried well, the sheet only partially attaches thereto. Thus, a conventional rubberized asphalt sheet ~~has rarely been used in recent~~ fallen into disfavor.

In the water soluble rubberized asphalt paint, asphalt is mixed and agitated with emulsifier, and latex is added thereto ~~then~~. Accordingly, ~~a construction of a connecting portion becomes simple~~application of asphalt paint (i.e. the waterproof material) is simplified. However, since a main ~~material~~ingredient of the paint is asphalt, ~~it~~the paint has the same drawbacks as ~~the foregoing a~~ rubberized asphalt sheet. Moreover, ~~the liquid asphalt paint is vulnerable to a concave-convex structure (i.e., it is impossible~~ difficult to apply to form a waterproof film having a constant thickness} if the construction surface is not planar.

~~The~~ A vulcanized rubber sheet is manufactured by boiling~~d~~ ~~in a manufacturing process, and~~ such a sheet has greater elasticity, tension, and tensile force ~~that are original properties of~~ than untreated rubber. Accordingly, the vulcanized rubber sheet is good for ~~shake-resistance, to vibration, shock-resistance, and~~ chemicalsresistance. In addition, physical ~~properties~~properties and

waterproof performance function thereof is are excellent. The vulcanized rubber sheet, however, ~~has is~~ difficulties in entirely to completely attaching to external walls of a structure ~~and performing construction of a connecting portion~~. This results in
5 water leakage and deterioration of the waterproof function.

In order to remedy drawbacks of the above-mentioned waterproof materials, ~~the organic solvent rubber paint is was~~ developed which uses rubber as a main base material. The rubber is redissolved in a volatile solvent, such as toluene and thinner,
10 using a liquid agitator, to manufacturing the organic solvent rubber paint. Compared with the vulcanized rubber sheet, the rubber paint makes it is simpler to perform the construction of the connecting portion use. When ~~a the~~ solvent is dried evaporated, the rubber paint is changed transformed to a rubber sheet. Therefore,
15 ~~the organic solvent rubber paint is~~ a good waterproof agent.

However, elasticity, peel strength, and tensile force of ~~the rubber~~ paint are lower than those of a vulcanized rubber sheet because the manufactured rubber sheet is ~~situated in~~ an unvulcanized rubber gray state. If a paint film waterproof agent using an oil
20 rubber as a main material is applied coated once, a rubber film is formed after ~~drying a~~ evaporation of the solvent. At this time, the rubber film ~~is shrunken~~ shrinks and ~~the a~~ thickness thereof is reduced to 0.2mm-0.4mm. In order to form a waterproof film having a constant thickness (1mm-2mm), ~~the waterproof agent~~
25 rubber paint should must repeatedly be coated. Since the

~~waterproof agent~~ each coat of rubber paint must be ~~is coated once~~
~~and~~ left for 5-6 hours so as to dry the solvent, soil or dust is fixed
to a coating surface. Therefore, the waterproof film is divided into
a plurality of films. Further, air bubbles or air pockets ~~is-are~~
5 considerably likelier to be created under the rubber film formed by
rubber paint.

Although concrete used in civil and construction structures is
dried well, it generally ~~contains~~ has a moisture content of 10%-
20%. In most case, concrete used in an underground structure
10 ~~contains~~ has a moisture content of 80%-90%. As mentioned above,
a-moisture content of the conventional waterproof agents is high.
Therefore, the agents cannot attach to the concrete. Although a
waterproof agent can be forcibly attacheds to concrete using a
lamp or a burner, ~~a waterproof~~ the resultant construction is still
15 ~~unstablye~~ attached and waterproof defects can be present ~~are~~
~~created in the construction.~~

In order to prevent damage of the waterproof film, the
conventional waterproof agents must use a waterproof film
protectant such as an EVA (ethylene vinyl acetate) bubbling sheet
20 or a PE (polyethylene) fibrous sheet. However, the protectant is
forced out or damaged and the waterproof film is attacked in a
refilling process. Unfortunately, the protectant causes the defects.
On the other hand, in order to protect the waterproof film, bricks
are laid to form a wall, and then a refilling process is carried out.

Such a manner ~~delays a~~ increases both the term of the works and ~~requires excessive the~~ cost.

SUMMARY OF THE INVENTION

5 It is therefore an object of the invention to provide a method of manufacturing an unvulcanized adhesive waterproof sheet and a construction method using the sheet which can simply perform a waterproof construction of a civil structure ~~or a construction structure,~~ and maintain ~~a waterproof function~~ performance for a
10 long time.

It is another object of the invention to provide a method of manufacturing an unvulcanized adhesive waterproof sheet and a construction method using the sheet which can easily and stably ~~perform~~ be attached ~~a waterproof construction to a~~ construction
15 surface containing humidity or moisture.

According to an aspect of the invention, a method of manufacturing an unvulcanized adhesive waterproof sheet comprises the steps of agitating a rubber main material composed of at least one of a natural rubber and a synthetic rubber with a
20 vulcanizing compound agent, an age resister, an adhesion-providing agent, a softener, and a filler, and then adding and agitating a vulcanizing agent thereto in an open roller, thereby producing a raw rubber material; rolling and forcing out the raw rubber material with constant width and thickness, thereby
25 manufacturing a waterproof sheet; and ~~making~~ attaching a

releasing paper ~~attach~~ to both surfaces of the waterproof sheet,
being cut with a constant length.

The age resister includes at least one compound selected
from a group consisting of phenylisopropyl-p-phenyllenediamin,
5 polymerized trimethyl dihydroquinoline, and styremeated phenol.
The adhesion-providing agent includes at least one of tragacanth
rubber and polyvinyl poval (PVA) that is affined with water.

According to another aspect of the invention, ~~there is a~~
construction method ~~using~~ uses the unvulcanized adhesive
10 waterproof sheet. One surface of the waterproof sheet attaches to
a surface of a structure ~~surface~~. The other sheet surface thereof
attaches to wet mortar, the sheet having ~~with a~~ constant
thickness. At this time, the waterproof sheet is turned into a
vulcanized rubber so as to achieve waterproofness of the structure
15 ~~after the construction~~ attachment thereto of the sheet.

Before the waterproof sheet attaches to the surface, premier
~~which is (produced by redissolving the raw rubber material in~~
organic solvent) is coated on the ~~structure~~ construction surface.
When the waterproof sheet attaches to the surface, the waterproof
20 sheet and the ~~structure~~ construction surface are coupled and
~~overlapped~~ opposed with each other. Then, the overlapped portion
adheres to the construction surface ~~using~~ via the premier. Before
the waterproof sheet attaches to the surface, a ~~portion of~~ water
leakage, ~~which is~~ may be caused by cracks of the ~~structure~~
25 construction surface, ~~is~~ are closed using an adhesion agent

produced by ~~redissolving~~ the raw rubber material in a ~~constant~~
selected amount of organic solvent. After the cracks are closed
using the adhesion agent, the premier is coated on the surface.

5 DESCRIPTION OF THE PREFERRED EMBODIMENT

~~In functions, a~~A waterproof agent made of asphalt is superior
~~in performance~~ to that made of rubber. Accordingly, ~~the inventor~~
~~of this invention thinks that a~~ perfect waterproof sheet must have
~~conditions characteristics~~ as follows. First, an ideal rubber film
10 has a constant thickness. Second, ~~connection parts~~ the elements
of the composite are monolithically and easily coupled to each
other, and perfectly attach to each other. Third, a waterproof
sheet to be used in construction ~~is performed using~~ should be a
vulcanized rubber sheet having good elasticity, tension, and
15 tensile force that are intrinsic properties of a rubber. ~~In view of~~
~~such facts, the inventor previously got~~ Reference is directed to
patents using an unvulcanized adhesive waterproof sheet using
rubber as a main material (Korean Patent Application No. 95-5008
entitled "MANUFACTURING METHOD OF UNVULCANIZED
20 ADHESIVE WATERPROOF SHEET AND CONSTRUCTION
METHOD THEREOF" and Korean Patent Application No. 96-37884
entitled "METHOD OF MANUFACTURING UNVULCANIZED
ADHESIVE WATERPROOF SHEET ").

In these patents, an adhesive gray-state unvulcanized
25 waterproof sheet ~~adding with~~ a vulcanized agent is manufactured

with to have a constant width and thickness. Accordingly, in a construction process using the sheet, ~~a construction~~ the thickness is constant and ~~connecting parts~~ attaching surfaces are monolithically attacheds to each other. This makes it possible to
5 ~~construct~~ attach a piece of rubber sheet to even a wide area ~~using a piece of rubber sheet~~. The sheet is secondarily-activated at ordinary temperature, being turned into a vulcanized rubber sheet. Tension and tensile force of the sheet can fill concrete cracks due to ~~suture~~ sealing thereof. As a result, the sheet provides a perfect
10 water-stopping effect.

However, the adhesive gray-state unvulcanized waterproof sheet adding a vulcanized agent ~~must~~ suffers from an aging phenomenon. For example, when the sheet is exposed to sunshine, rain, and wind on a rooftop of a building for three or
15 four months, cracks are created on a surface of the sheet. Therefore, the present invention provides a new and improved manufacturing method of an unvulcanized adhesive waterproof sheet and a waterproof construction thereof, with repetitive test and study.

20 The use of the present adhesive waterproof sheet in construction ~~of this invention~~ is performed through the following steps. Primer ~~that is~~ (produced by redissolving a raw material of rubber in a constant amount of organic solvent) is coated on a construction surface. The unvulcanized rubber sheet is attached to
25 the surfaces. Wet cement mortar, which is kneaded with water,

attaches ~~for to protecting an the attached~~ing waterproof film. The
mortar is hardened and cured. Finally, a refilling process is
performed. After the waterproof construction is finished, the sheet
is activated to be a molded~~ing~~ vulcanized rubber with time. More
5 specifically, primer is coated on, e.g., a cut and cover tunnel, an
underground structure of a building, and a building wall. With an
adhesive unvulcanized rubber sheet ~~of in an~~ adhesive rubber gray
state, an attach~~menting to the~~ construction surface is
monolithically performed without an expansion opening. Wet
10 mortar kneaded with water attaches onto a surface of the
~~attaching waterproof sheet. Moisture of t~~The wet mortar is dried
and cured. Since the mortar and adhesive unvulcanized rubber
~~have adhesion then~~are adhesive, they strongly attach. The
unvulcanized rubber sheet is secondarily-activated at ordinary
15 temperature, being turned into a molded~~ing~~ vulcanized rubber
sheet. ~~And then, t~~The molding vulcanized rubber sheet then is
turned into a rubber sheet having elasticity, tension, and tensile
force that are intrinsic properties of the rubber, ~~exerting creating a~~
perfect waterproof construction effect. Using the molded and
20 vulcanized rubber sheet as a medium, both walls attach to each
other by concrete. Therefore, it is possible to achieve ~~perform a~~
waterproof construction process without defects in
waterproofness.

An unvulcanized adhesive waterproof sheet of this invention
25 is produced by adding a rubber material composed of at least one

of natural rubber and synthetic rubber to a vulcanizing agent, an age resister, an adhesion-providing agent, a softener, a filler, and a vulcanizing agent. Such agents are added to natural rubber or synthetic rubber or combination thereof or a combined rubber
5 produced by adding rubber powder or recycled rubber to the natural rubber or the synthetic rubber. The agents and one of the rubbers are then mixed and agitated in a closed mixer (e.g., kneader or ~~bumberey~~ Bandury), being evenly distributed. And then, ~~t~~The agitation is performed in an open roller, with adding
10 addition of the vulcanizing agent. The agitated raw material of the adhesive rubber is rolled in a calender, having a constant width and a thickness of 1mm-5mm. The rolled material is fetched to the sheet, and then is cut with a constant thickness. Finally, the rolled and fetched rubber sheet is rolled up, with silicon-coated
15 releasing paper attaching to both surfaces thereof.

The unvulcanized adhesive rubber sheet ~~is~~ can be used for ~~unexposure~~ in construction applications where the sheet will be exposed to the weather. Durability of the sheet is ~~over the warranty (five years)~~. In order to maintain a waterproof function
20 for a long time, it is required to add a special age resister to the sheet. Therefore, the present invention uses age resisters, such as "3C" (Phenylisopropyl-p-phenylenediamin), "RD" (Polymerized trimethyl dihydroquinoline), and "SP" (Styrenated phenol). The
"3C" compound is good for heat resistance, flexure-crack
25 resistance, oxidation resistance, and ozone resistance. The "RD"

compound is good for heat resistance and oxidation resistance.

And, ~~the~~ The "SP" compound is good for flexure resistance, oxidation resistance, and ozone resistance. Adding such age resisters to the sheet results in a, ~~the sheet which maintains an its~~ initial state for a long time. When the sheet attached ~~ing to a wall of a rooftop~~ is left for two years (two summers and winters), cracks or rips are not created on a surface of the sheet. In case of an sun exposure construction application, the sheet exerts an excellent waterproof function for a long time.

Generally, a waterproof construction process ~~is performed to~~ desirable for an external wall of a structure. Accordingly, the construction is performed ~~to in~~ an external wall of concrete using a waterproof material. In order to protect the waterproof material, an EVA blowing sheet or PE fibrous sheet is applied to an outside of the waterproof material. However, the EVA blowing sheet or PE fibrous sheet is difficult ~~in to~~ attaching to a corner or a flexure (curved construction surface), and incompletely attaches to the waterproof material. In a refilling process, a protectant is forced out or damaged and a waterproof film is attacked. Unfortunately, the protectant also causes defects. Instead of EVA blowing sheet and PE fiber, cement mortar is used as a waterproof protectant so as to solve such defects and protect a waterproof film. Therefore, the rubber sheet can be simply attached to a corner or a complex flexure ~~can simply be constructed~~. Using a waterproof sheet as a sandwiched medium, an inside construction surface adheres to an

outside construction surface ~~by concrete~~, the sheet being closed therebetween to achieve a perfect waterproof construction.

In order to use mortar as a waterproof film protectant, the unvulcanized adhesive waterproof sheet adds Tragacanth Gum and PVA (polyvinyl Poval) resin to the adhesion-providing agent. The Tragacanth Gum and PVA resin is affined with water and is compatible with other material, being mixed well. The sheet containing an adhesion-providing agent and the raw rubber material are ~~redissolved~~ in a constant amount of organic solvent, forming premier which enables the sheet to perfectly attach to a ~~structure~~ construction surface containing ~~humidity or moisture~~. Even though an underground structure contains moisture on the order of 80%-90%, the sheet can eminently attach thereto. According to ~~an experimental results of the inventor~~, when the premier is coated on a brick or a concrete piece with gathered water and the unvulcanized adhesive rubber sheet adheres thereto, the adhesion ~~becomes~~ is strong. Since a surface of a structure in a work site generally has poor adherence conditions, the primer is used ~~for to enableing~~ an unvulcanized adhesive waterproof sheet to attach to a ~~structure~~ construction surface. And, the primer is used at an overlap portion of waterproof sheets.

In order to overcome conventional problems (exfoliation, cement exclusion, crack, etc.), the premier is coated on an external surface of concrete and the unvulcanized adhesive rubber sheet adheres thereon. Then, wet mortar kneaded with water

attaches to a surface of the sheet. If the water is dried and
adhesion is created ~~in-by~~ curing the cement mortar, ~~a-the~~
waterproof film and the cement mortar strongly attach to each
other. The sheet attaching ~~in-to~~ the mortar can absorb external
5 impact and suppress creation of cracks.

~~On the other hand~~In another embodiment, ~~the-a~~ construction
method using the unvulcanized adhesive waterproof sheet utilizes
putty that is produced by ~~re~~dissolving a raw rubber material in
organic solvent such as toluene. The putty ~~closes-a portion of~~
10 seals and prevents water leakage caused by cracks ~~of-a structure~~
in a construction surface. Using the putty, the cracks are closed.
If the premier is then coated on the ~~structure~~construction surface
repeatedly and the sheet attacheds thereon, ~~the-more perfect-a~~
better construction will be achieved.

15 In view of the cost, a waterproof construction method using
an unvulcanized adhesive waterproof sheet is cheaper than a
conventional method using an EVA blowing sheet, ~~and-a~~ PE
fibrous sheet or a bricklaying method. And, such a waterproof
construction method can solve conventional difficulties (e.g., a
20 waterproof construction cannot be performed to a wet mortar
kneaded in water as well as to-a structure surface having humidity
or moisture, and the construction ~~is-forcibly performed-in these~~
situations tends to create-result in construction defects).

PREFERRED EMBODIMENT

An unvulcanized adhesive waterproof sheet of this invention is composed of composites having a mixture ratio, as follows:

5 **(Table unchanged from Original Specification)**

Intrinsic physical properties and characteristics of the rubber compound materials are different from each other. Therefore, based on usage of a waterproof sheet or ~~requisition of a user~~
10 preference, only one of ~~the natural rubbers, and~~ synthetic rubbers, or a combination thereof may be used. Alternatively, two and more kinds of synthetic rubbers may be used. For example, a CR rubber main material has the best properties such as adhesion, durability, and chemical resistance.

15 The age resisters (3C, RD, and SP) are added to an unvulcanized adhesive waterproof sheet, improving durability. In order to maintain strong adhesion between composites of the sheet and provide adhesiveness, the adhesion-providing agents (polybutene, phenol-formaldenhyde-resin, and petroleum resin)
20 are added thereto. And, in order to provide adhesion and adhesiveness to wet mortar kneaded with water and a structure having humidity and moisture, the tragacanth gum and the PVC resin which are compatible with other composites are added thereto. Since there are synergy and compatibility between a resin
25 of an adhesion-providing agent and a water-compatible resin,

adhesion and adhesiveness can be improved. And, a waterproof construction can smoothly be performed at dry and wet ~~portions~~conditions.

A method of manufacturing an unvulcanized adhesive waterproof sheet is composed of the following steps. One of natural and synthetic rubbers (SBR rubber, 1R rubber, EPT rubber, 2R rubber, CR rubber, NBR rubber, Urethane rubber, and CPE rubber) or combination (100%) thereof is fully agitated in a closed mixture agitator "Kneader Mixer" or "Bandury Mixer". The vulcanizing compound agents, stearic acid (1%), magnesium oxide (5%), zinc oxide (5%), and sulfur (2%) are evenly mixed therewith. The age resisters, 3C (2%), RD (1.5%), and SP (2%) are then agitated, being mixed and distributed evenly. Then, the adhesion-providing agents, polybutene (6%), phenol-formaldehyde-resin (8%), petroleum resin (10%), tragacanth gum (5%), and PVA (12%) are fully mixed and agitated therein. And then, the softener, process oil (14%) as well as the filler, calcium carbonate (40%) and clay (15%) are fully mixed and agitated therewith. With adhesive unvulcanized raw rubber material agitated in a roller, vulcanizing agents, DM (1.5%), D (1%), T/T (1%), and NA22 (1%) are added, being distributed and mixed evenly. In a calendaer machine, the sheet is rolled and forced out with a constant width and a thickness of 1mm-5mm. Finally, the sheet is adhereds to releasing paper of a high-density film (HD), polypropylene (PP), and polyethylene (PE), ~~being~~ rolled up and cut with a constant

length. The releasing paper of the rolled waterproof sheet must be uncovered in a waterproof construction. To be used as a material of the releasing paper, silicon is coated on both surfaces of a synthetic resin film such as HD, PP, and PE.

5 Since the unvulcanized adhesive waterproof sheet has ~~adhesion~~adhesiveness therein, its adhesion to concrete is excellent. However, a construction surface of a ~~construction~~ structure in a work site is generally contaminated by cement powder, soil, dust, and ~~fillth~~dirt. Accordingly, the waterproof
10 construction method utilizes premier (viscosity, 500-600) ~~that are~~ produced by ~~redissolving~~ the raw rubber material (weight, 50) in toluene (weight, 150). That is, the premier is rendered on a concrete surface and the unvulcanized waterproof sheet attaches thereto, achieving a stronger ~~adhere~~ construction attachment.
15 Similarly, a coupling portion more strongly adheres by means of the premier.

 In comparison with a conventional method, the present invention makes it possible to simply coat the premier on a structure using a brush. The premier can ~~strongly~~ effectively be
20 coated on even metal or rusted iron, so that the unvulcanized waterproof sheet simply and strongly attaches thereto.

 In case of water leakage caused by cracks of a ~~structure~~ construction surface, an adhesion agent (viscosity, 1500-1700) ~~that is~~ produced by resolving the raw rubber material (weight, 500)
25 in toluene (weight, 70) is utilized. After the cracks are closed

using the adhesion agent, the water leakage is stopped and the premier is coated thereon. After solvent is dried and a premier film is formed, the premier recoated thereon. A rubber sheet strongly attaches to the premier then, so that adhesion is achieved.

5 In the waterproof construction method, the unvulcanized adhesive waterproof sheet attaches to a ~~structure~~construction surface. Mortar of 10mm-20mm then attaches to a surface of the waterproof sheet. The more a cement component is contained in mortar~~is~~, the better adhesion is. Accordingly, a~~this~~quality of the
10 mortar is ~~at least~~ higher than that of standard mortar (cement 1 : sand 2.5). Moisture of the attaching cement mortar is ~~vaporized~~evaporated to create adhesion. After five or seven days, the mortar is cured to have strong adhesion. The attaching mortar having the strong adhesion can resist external impact (i.e.,
15 overcome exfoliation, evasion, breakage, and cracks). Using the unvulcanized adhesive waterproof sheet as a medium, internal and external walls completely attach to each other. Thus, defects cannot occur.

In a waterproof construction to an external wall of a building,
20 the premier is coated on the external wall to form a rubber film. Mortar kneaded with water attaches to a surface of the rubber film, being cured. Sidewalls are refilled with a good quality of earth and sand. Then, water is sprayed to harden the earth and sand. An underground parking lot or a rooftop is ~~subject~~amenable
25 to a mortar (thickness, 2cm-3cm) construction, and is refilled with

~~in the same manner. So that~~ The waterproof construction is
~~finished then conducted as previously described.~~ At ordinary
temperatures, the unvulcanized adhesive waterproof sheet is
secondarily-activated, being turned into a vulcanized rubber with
5 over time (1-2 months in summer, 2-3 months in winter).

Therefore, the waterproof sheet has high tension and tensile
force, and maintains a its waterproof function. Further, heat
resistance, cold resistance, and chemical resistance of the
waterproof sheet ~~is so~~ are sufficiently good that the waterproof
10 sheet can ~~exert~~ maintain its good physical properties in a severe
conditions. As a result, the waterproof sheet can maintain a
waterproof function ~~until a civil and construction~~ over the life of
the building is deconstructed.

In the drawings and specification, there have been disclosed
15 typical preferred embodiments of the invention and, although
specific terms are employed, they are used in a generic and
descriptive sense only and not for purpose of limitation, the scope
of the invention being set forth in the following claims.

CLAIMS

What is claimed is:

(Claims 12-14 and 17 per the Amendment submitted herewith)

ABSTRACT OF THE DISCLOSURE

A method of manufacturing an unvulcanized adhesive waterproof sheet for performing a waterproof construction ~~to a concrete surface~~, and a construction method using the sheet are described. In the manufacturing method, a rubber main material composed of ~~at one of a natural rubber and/or a synthetic rubber~~ are is agitated with a vulcanizing compound agent, an age resister, an adhesion-providing agent, a softener, and a filler. A ~~v~~Vulcanizing agent is then added and agitated thereto in an open roller, thereby producing a raw rubber material, which. ~~The raw rubber material is rolled and forced out with constant width and thickness, thereby manufacturing a waterproof sheet.~~ A releasing paper attaches to both surfaces of the waterproof sheet, ~~being cut with a constant length.~~ In the construction method, one surface of the waterproof sheet attaches to a construction surface ~~of a structure surface~~. The other sheet surface thereof attaches to wet mortar with a constant thickness. ~~At this time, t~~The waterproof sheet is turned into a vulcanized rubber over time ~~so as to achieve waterproofness~~ of the ~~structure after the construction.~~

20